

What is claimed is:

1. A network management system comprising:

a communication network having a first edge node serving as an entrance unit to said network for a transfer signal passing through said network, a second edge node serving as an exit unit used to send out said transfer signal from said network to an outside and a relay node being mounted between said first edge node and said second edge node and on a transfer route extending from said first node to said second node;

a path information acquiring unit being connected to said first edge node and second edge node so as to be communicable with said first and second edge nodes and being used to send out a tracing signal used to trace said transfer signal along said transfer route on which said transfer signal has passed, to said first edge node, and being used to acquire information about a path through which said transfer signal passes; and

wherein each of said nodes is made up of a path information holding unit used to hold information about said path through which said transfer signal passes, a tracing signal residing unit used to make said tracing signal be resident when having received said tracing signal and to produce a replica of said tracing signal and a tracing signal transmitting unit used to feed said replica of said tracing signal to said nodes being adjacent to each other on said transfer route and

wherein said path information acquiring unit used to acquire said information about said path on said transfer route for said transfer signal extending from said first edge node to said second edge node, from one node out of a plurality of said nodes.

2. The network management system according to Claim 1, wherein said path information holding unit is used to insert said path information into said tracing signal being resident in said node having said path information holding unit.

3. The network management system according to Claim 1, wherein said path information holding unit holds said path information so as to be associated with said tracing signal which resides in said node having said information holding unit.

4. The network management system according to Claim 1, wherein said path information acquiring unit feeds information collecting signal used to collect said path information being held by each of said nodes on said transfer route for said transfer signal, to said first edge node.

5. The network management system according to Claim 4, wherein each of said nodes further comprises an information collecting signal processing sending unit used to insert, when having received said information collecting signal, said path information being held by said information collecting signal processing sending unit, into said information collecting signal and used to feed said collecting signal to said nodes being adjacent to each other on said transfer route.

6. The network management system according to Claim 1, wherein said path information acquiring unit receives said path information for said transfer route of said transfer signal extending from said first edge node through said relay node to said second edge node, from said second edge node.

7. The network management system according to Claim 5, wherein said path information acquiring unit receives said information collecting signal fed from said first edge node through said relay node to said second edge node, from said second edge node.

8. The network management system according to Claim 1, wherein said path information held by said path information holding unit contains information about paths leading to said node having said path information holding unit and wherein said path information acquiring unit acquires all path information for said transfer signal by receipt of said tracing signal having said path information from said second edge node.

9. The network management system according to Claim 1, wherein said path information acquiring unit is a network management unit and wherein said network management unit feeds said tracing signal to said first edge node.

10. The network management system according to Claim 4, wherein said path information acquiring unit is a network management unit and wherein said network management unit feeds said information collecting signal to said first edge node.

11. The network management system according to Claim 1, wherein a user terminal serving as a sender of said transfer signal is connected to said first edge node and wherein said network management unit acquires said path information in accordance with an instruction fed from said user terminal.

12. The network management system according to Claim 1, wherein said path information acquiring unit is a user terminal serving as a sender of said transfer signal and being connected to said first edge node and wherein said user terminal feeds said tracing signal to said first edge node.

13. The network management system according to Claim 4, wherein said path information acquiring unit is a user terminal serving as a sender of said transfer signal and being connected to said first edge node and wherein said user terminal feeds said information collecting signal to said first edge node.

14. The network management system according to Claim 1, wherein said network is of a connectionless-mode communication type.

15. The network management system according to Claim 1, wherein each of said signals is handled in a form of a packet and wherein said tracing packet has a tracing processing program to trace said transfer packet and wherein said path information acquiring unit sends out a quality control packet having a program to control a quality of communications in each of said nodes and a driving packet having a driving program to start said control program contained in said quality control packet, to said first edge node.

16. The network management system according to Claim 15, wherein said path information acquiring unit simultaneously sends out said tracing packet and said quality control packet.

17. The network management system according to Claim 15, wherein said tracing signal residing unit is made up of a first storing section to store said

tracing packet fed from said path information acquiring unit and a first packet executing section to execute said program contained in said tracing processing packet in said first storing section and to insert said path information in said transfer packet into said tracing packet and

wherein said tracing signal sending unit has a first packet sending section used to feed said tracing packet into which said path information has been inserted by said first packet executing section and said quality control packet fed from said path information acquiring unit, to said nodes being adjacent to each other on said transfer route for said transfer packet and

wherein each of said nodes is further provided with a second storing section used to store said quality control packet, a third storing section used to store said driving packet fed from said path information acquiring unit, a third packet executing section used to execute said program contained in said driving packet in said third storing section and to produce a driving instruction to start said program contained in said quality control packet in said second storing section, a second packet executing section used to execute said quality control program driven by said driving instruction and to control said communication quality and a second packet sending section used to feed said driving packet to said nodes being adjacent to each other on said transfer route for said transfer packet.

18. The network management system according to Claim 17, wherein said path information acquiring unit receives said tracing packet, said quality control packet and said driving packet fed to said second edge node from said first edge node through said relay node, from said second edge node.

19. The network management system according to Claim 17, wherein said

second packet executing section acquires results from said quality control processing.

20. The network management system according to Claim 19, wherein said path information acquiring unit feeds an information collecting packet containing an information collecting program used to collect said path information being held by each of said nodes on said transfer route for said transfer packet, to said first edge node.

21. The network management system according to Claim 20, wherein said third storing section stores said information collecting packet fed from said path information acquiring unit and wherein said third packet executing section executes said collecting program contained in said information collecting packet in said third storing section and inserts information about results from said communication quality control into said information collecting packet and wherein said second packet sending section feeds said information collecting packet to said nodes being adjacent to each other on said transfer route.

22. The network management system according to Claim 21, wherein said path information acquiring unit receives said information collecting packet fed from said first edge node through said relay node to said second edge node, from said second edge node.

23. The network management system according to Claim 18, wherein said path information acquiring unit is a network management unit.

24. The network management system according to Claim 22, wherein said path information acquiring unit is a network management unit.

25. The network management system according to Claim 23, wherein a communication server or a user terminal serving as a sender of said transfer signal is connected to said first edge node and wherein said network management unit sends out said tracing processing packet, said quality control packet and said driving packet in accordance with an instruction fed from said server or said user terminal.

26. The network management system according to Claim 25, wherein said network management unit sends out said information collecting packet in accordance with an instruction fed from said server or said user terminal.

27. The network management system according to Claim 15, wherein said path information acquiring unit is a communication server being connected to said first edge node or a user terminal serving as a sender of said transfer signal being connected to said first edge node.

28. The network management system according to Claim 20, wherein said path information acquiring unit is a communication server being connected to said first edge node or a user terminal serving as a sender of said transfer packet being connected to said first edge node.

29. The network management system according to Claim 17, wherein said network is of a connectionless-mode communication type.

30. The network management system according to Claim 1, wherein each of said signals is handled in a form of a packet and wherein said tracing packet has a tracing processing program to trace said transfer packet and wherein said path information acquiring unit sends out a filtering processing packet containing a filtering processing program to select a transfer packet fed from said each of nodes based on a predetermined condition and a driving packet having a driving program to start said program contained in said processing packet, to said first edge node.

31. The network management system according to Claim 30, wherein said path information acquiring unit simultaneously sends out said tracing packet and said filtering processing packet.

32. The network management system according to Claim 30, wherein said tracing signal residing unit is provided with a first storing section used to store said tracing packet fed from said path information acquiring unit and with a first packet executing section used to execute said processing program contained in said tracing packet in said first storing section and to insert said path information in said transfer packet into said tracing packet and

wherein said tracing signal sending unit is provided with a first packet sending section used to feed said tracing packet into which said path information has been inserted by said first packet executing section and said transfer packet fed from said path information acquiring unit to said nodes being adjacent to each other on said transfer route for said transfer packet and

wherein each of said nodes is further provided with a second storing section used to store said filtering processing packet, with a third storing section used to store said driving packet fed from said path information



acquiring unit, with a third packet executing section used to execute said driving program contained in said driving packet in said third storing section and to produce a driving instruction to start said program contained in said filtering processing packet in said second storing section, with a second packet executing section used to execute said filtering processing program driven by said driving instruction and to perform said filtering processing and with a second packet sending section used to feed said driving packet to said nodes being adjacent to each other on said transfer route for said transfer packet.

33. The network management system according to Claim 32, wherein said second packet executing section acquires information about results from said filtering processing.

34. The network management system according to Claim 33, wherein said path information acquiring unit feeds an information collecting packet having an information collecting program to collect said path information being held by each of said nodes on said transfer route for said transfer packet, to said first edge node.

35. The network management system according to Claim 34, wherein said third storing section stores said information collecting packet fed from said path information acquiring unit and wherein said third packet executing section executes said collecting program contained in said information collecting packet in said third storing section and inserts information about results from said filtering processing into said information collecting packet and wherein said second packet sending section feeds said information collecting packet to said nodes being adjacent to each other on said transfer

routes.

36. The network management system according to Claim 35, wherein said path information acquiring unit receives said information collecting packet fed to said second edge node from said first edge node through said relay node, from said second edge node.

37. The network management system according to Claim 30, wherein said path information acquiring unit is a network management unit and wherein said network management unit has a first packet producing and transmitting section used to produce said tracing packet and said filtering processing packet and to send out both said packets and a second packet producing and transmitting section used to said driving packet and to send out said driving packet and wherein, after said tracing processing packet and said filtering packet have been sent out from said first packet producing and transmitting section, said driving packet is transmitted from said second packet producing and transmitting section.

38. The network management system according to Claim 34, wherein said path information acquiring unit is a network management unit and wherein said network management unit is provided with a first packet producing and transmitting section used to produce said tracing packet and said filtering processing packet and to send out said both packets, with a second packet producing and transmitting section used to produce said driving packet and to send out said produced driving packet and with a third packet producing and transmitting section used to produce said information collecting packet and to send out said produced information collecting packet and wherein, after said

tracing processing packet and said filtering processing packet have been sent out from said first packet producing and transmitting section, said driving packet is sent out from said second packet producing and transmitting section and, after said transmission of said driving packet, said information collecting packet is sent out from said third packet producing and transmitting section and said information collecting packet fed to said second edge node through said relay node from said first edge node is received from said second edge node.

39. The network management system according to Claim 37, wherein a communication server or a user terminal serving as a sender of said transfer signal is connected to said first edge node and wherein said network management unit sends out said tracing processing packet, said filtering processing packet and said driving packet in accordance with an instruction fed from said communication server or said user terminal.

40. The network management system according to Claim 38, wherein a communication server or a user terminal serving as a sender of said transfer signal is connected to said first edge node and wherein said network management unit sends out said tracing processing packet, said filtering processing packet, said driving packet and said information collecting packet in accordance with an instruction fed from said communication server and user terminal.

41. The network management system according to Claim 30, wherein said path information acquiring unit is a communication server being connected to said first edge node or a user terminal serving as a sender of said transfer

signal being connected to said first edge node.

42. The network management system according to Claim 36, wherein said path information acquiring unit is a communication server being connected to said first edge node or a user terminal serving as a sender of said transfer signal being connected to said first edge node.

43. The network management system according to Claim 32, wherein said network is of a connectionless mode communication type.

44. The network management system according to Claim 1, wherein each of said signals is handled in a form of a packet and wherein said tracing packet has at least a tracing processing program to trace said transfer packet and wherein said path information acquiring unit sends out a Service Level Agreement (SLA) management packet having a program to manage said SLA processing and check as to whether predetermined service is maintained in accordance with said SLA already agreed in advance between said network manager and a user and information collecting packet having an information collecting program to collect said path information held by each of said nodes on said transfer route for said transfer packet, to said first edge node.

45. The network management system according to Claim 44, wherein said path information acquiring unit simultaneously sends out said tracing packet and said SLA packet.

46. The network management system according to Claim 44, wherein said tracing signal residing unit is provided with a first storing section used to store

said tracing packet fed from said path information acquiring unit and with a first packet executing section used to execute said processing program contained in said tracing packet in said first storing section and to insert said transfer information in said transfer packet into said tracing packet and wherein said tracing signal sending unit has a first packet sending section used to feed said tracing packet into which said path information has been inserted by said first packet executing section and said SLA management packet fed from said path information acquiring unit to said nodes being adjacent to each other on said transfer route for said transfer packet and wherein each of said nodes is further provided with a second storing section used to store said SLA management packet, with a second packet executing section used to execute said management program contained in said SLA management packet in said second storing section and to acquire information about results from transfer management of said transfer packet, with a third storing section used to store said information collecting packet fed from said path information acquiring unit, with a third packet executing section used to execute said collecting program contained in said information collecting packet in said third storing section and to insert information about results from management obtained from said second packet executing section into said information collecting packet and with a second packet sending section used to feed said information collecting packet into which information about said management results is inserted by said third packet executing section to said nodes being adjacent to each other on said transfer route for said transfer packet.

47. The network management system according to Claim 46, wherein said second storing section stores said information about results from said

management obtained by said second packet.

48. The network management system according to Claim 46, wherein said third packet executing section inserts said packet information contained in said transfer packet into said information collecting packet.

49. The network management system according to Claim 46, wherein said path information collecting unit receives said information collecting packet fed to said second edge node through said relay node from said first edge node, from said second edge node.

50. The network management system according to Claim 44, wherein said path information acquiring unit, when having judged, based on predetermined conditions, that said transfer route for said transfer packet is put in a congestion state, sends out a congestion avoiding packet having a program to reduce said congestion state so that said transfer packet is able to avoid said congestion.

51. The network management system according to Claim 50, wherein said third storing section stores said congestion avoiding packet fed from said path information acquiring unit and wherein said third packet executing section executes said congestion avoiding program contained in said congestion avoiding packet in said third storing section and wherein said second packet sending section feeds said congestion avoiding packet to said nodes being adjacent to each other on said transfer route.

52. The network management system according to Claim 51, wherein said

path information acquiring unit receives said congestion avoiding packet fed to said second edge node through said relay node from said first edge node, from said second edge node.

53. The network management system according to Claim 49, wherein said path information acquiring unit is a network management unit and wherein said network management unit is provided with a first packet producing and transmitting section used to produce said tracing packet and said SLA management packet and to send said both produced tracing processing packet and SLA management packets, with a second packet producing and transmitting section used to produce said information collecting packet and to send out said produced packet and with a first packet receiving section to receive said information collecting packet and wherein, after said transmission of said tracing processing packet and said SLA management packet from said first packet producing and transmitting section, said information collecting packet is sent out from said second packet producing and transmitting section.

54. The network management system according to Claim 52, wherein said path information acquiring unit is a network management unit and wherein said network management unit is provided with a first packet producing and transmitting section used to produce said tracing packet and said SLA management packet and to send out said both packets, with a second packet producing and transmitting section used to produce said information collecting packet and to send out said produced packet, with a third packet producing and transmitting section used to produce said congestion avoiding packet and to send out said produced packet, based on said predetermined conditions, and with a second packet receiving section used to receive said information

collecting packet and said congestion avoiding packet and wherein, after transmission of said tracing processing packet and said SLA management packet from said first packet producing and transmitting section, said information collecting packet is sent out from said second packet producing and transmitting section and, after said transmission of said information collecting packet, said congestion avoiding packet is sent out, whenever necessary, from said third packet producing and transmitting section.

55. The network management system according to Claim 54, wherein said predetermined condition for said congestion avoiding packet is that said information collecting packet is not supplied to said path information acquiring unit within a fixed time.

56. The network management system according to Claim 53, wherein a communication server or a user terminal serving as a sender of said transfer signal is connected to said first edge node and wherein said network management unit, based on an instruction fed from said server or user terminal, sends out said tracing processing packet, said SLA management packet and said information collecting packet.

57. The network management system according to Claim 54, wherein a communication server or a user terminal serving as a sender of said transfer signal is connected to said first edge node and wherein said network management unit, based on an instruction fed from said server or user terminal, sends out said tracing processing packet, said SLA management packet, said information collecting packet and said congestion avoiding packet.



58. The network management system according to Claim 46, wherein said third packet executing section inserts information about time when execution of said information collecting program has started and about time when running of said information collecting program has ended, into information about results from said management.

59. The network management system according to Claim 49, wherein said SLA management unit used to manage said SLA is connected to said path information acquiring unit and wherein said path information acquiring unit, based on said management result information being stored in said information collecting packet fed from said second edge node and on unit information being able to be obtained for every unit of predetermined information about said management results, produces information about a return to a user of said network and feeds said information about said returns to said SLA management unit.

60. The network management system according to Claim 54, wherein said network management unit inserts information about a first time showing time when said third packet producing and transmitting section has transmitted said congestion avoiding packet, into said congestion avoiding packet and information about a second time showing time when said second packet receiving section has received said congestion avoiding packet, into said congestion avoiding packet.

61. The network management system according to Claim 60, wherein said LSA management unit used to control said SLA is connected to said network

management unit and wherein said network management unit, based on information about a third time showing a difference between said first time and said second time contained in said congestion avoiding packet having received by said second packet receiving section and on unit time information obtained for every predetermined information unit of said third time information, produces information about said return for a user of said network and feeds said information about said return to said SLA management unit.

62. The network management system according to Claim 46, wherein said network is of a connectionless mode communication type.

63. A node for being used in a communication network which is mounted on a transfer route for a transfer signal passing through said network and which receives a tracing signal used to trace said transfer signal and which stores information about a path on said transfer route for said transfer signal, comprising:

a path information holding unit to hold information about said path for said transfer signal passing through said path information holding unit;

a tracing signal residing unit, when having said tracing signal, to cause said tracing signal to be resident in said tracing signal residing unit and to produce a replica of said tracing signal; and

a tracing signal sending unit to feed said replica of said tracing signal to nodes being adjacent to each other on said transfer route for said transfer signal.

64. A path information acquiring unit being mounted on a transfer route of a transfer signal passing through a communication network comprising:

a first node used to receive a tracing signal which traces said transfer signal and which contains information about a path on said transfer route for said transfer signal;

a second node being mounted on said transfer route for said transfer signal and being used to receive said tracing signal; and

wherein said path information acquiring unit is connected to said first and second nodes so as to be communicable with each other and sends out said tracing signal to said first node and acquires path information contained in said tracing signal in transfer route for said transfer signal extending from said first node to said second node, from said second node.